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The Effect of Gender Schematicity on the Assessment of Male and Female Pilots' Competence Given Identical Scenarios

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THE EFFECT OF GENDER SCHEMATICITY ON THE ASSESSMENT OF MALE
AND FEMALE PILOTS' COMPETENCE GIVEN IDENTICAL SCENARIOS

By

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B.Eng., Royal Military College of Canada, 2000

A Thesis Submitted to the
Department of Human Factors & Systems
In Partial Fulfillment of the Requirements for the Degree of
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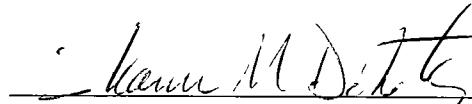
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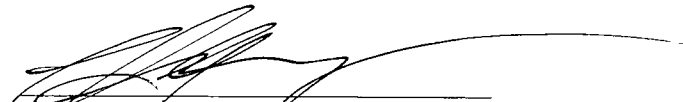
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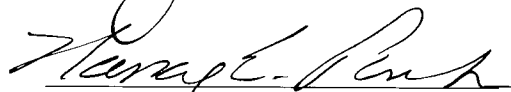
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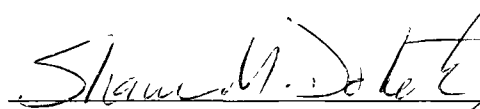
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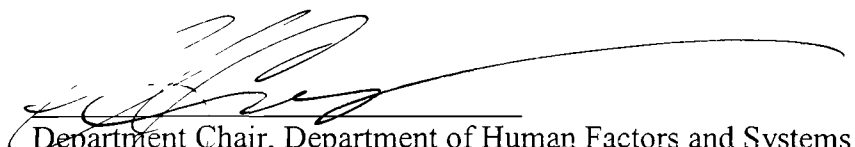
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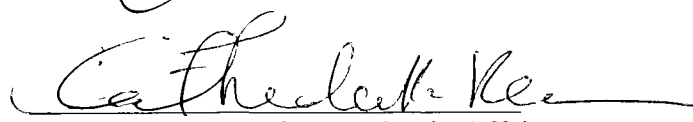

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Abstract

Gender has been identified as one of the top three categories, along with race, and age that are subject to stereotyping, prejudice and discrimination (Fiske, 1998). With the emergence of women in stereotypical male domains, gender research has never been more important. The aviation community is a prime example of one such domain.

This study examined the presence of an existing perception that male pilots are more competent than female pilots. It suggested that there does not appear to be evidence that would explain why there should be a difference in this perception of competence. It also discussed social theories of gender and more specifically Bem's Gender Schema Theory in an attempt to explain why this perception does exist.

The purpose of this study was to look at the effect of the gender schematicity of the participants and the gender of the pilot in a given scenario on the perceived competence of the pilot. A 3 X 2 between subjects, fully factorial ANOVA strategy was utilized and revealed no significant results for the main effects of scenario gender or schematicity or the interaction effect on perception of pilot competence. This study adds to the field of gender research but does not provide support for the conclusion that male and female pilots may be perceived differently while in the same situation and displaying the identical level of skill and ability.

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Introduction

Gender is one of the most significant categories in social life. Every existing culture has differentiated sets of concepts that categorize and separate between female and male roles, rights and responsibilities. In all cultures, females and males develop distinct sets of gender related beliefs and expectations that exert a powerful yet subtle influence on their thoughts, feelings and beliefs (Fiske, 1998). “Gender is a scheme for social categorization of individuals, and every known human society has some gender scheme. Every gender scheme recognizes biological differentiation while also creating social differentiations (Ecks & Trautner, 2000).” As a result, an individual’s thoughts, feelings, and behaviors are strongly influenced by the social and cultural factors that are associated with their distinctions between females and males.

Gender has been identified as one of the top three categories, along with race, and age, that are subject to stereotyping, prejudice, and discrimination (Fiske, 1998). As a result of its extreme impact on our everyday lives, gender research is one of the most active and dynamic areas in developmental and social psychology today. With the increasing numbers of women in the workplace and more specifically women in stereotypically male domains, gender research has never been more important. The evaluation of women working in a male dominated work environment can prove to be difficult. The assessment of an individual’s attributes when judged by a person with a biased perception, could affect one’s perception of competence.

The aviation community is a prime example of a male dominated domain. Today’s statistics indicate that a mere 6% of airline pilots are female (Women in Aviation International, 2001). The piloting occupation is considered a male domain. The

following literature explores why employment segregation exists within the workplace and more specifically within the aviation industry. Research illustrates that neither males nor females are superior biologically or cognitively with respect to aviation competence. Past literature on pilot error accident rates also demonstrates that females are just as safe, if not safer, than male pilots. Yet the perception still remains in the industry that males are more competent pilots than females (Davey & Davidson, 2000). The reasoning behind this misperception can be explained utilizing social psychological theories of gender. It is through research on the perception of female pilots that the challenges they face when pursuing a career in aviation can be brought to light.

When beginning a discussion on women working in the male dominated aviation industry, one must first consider how occupations become perceived as being male or female dominant.

Gender in the Workplace

In today's workplace there exists a division of labor. In the United States, 53% of women would have to change occupations in order to eliminate employment segregation and become distributed into occupations as men are distributed (Cejka, 1999). Women make up only 10% of senior level management positions in the United States (Gardiner & Tiggermann, 1999). A study completed in 1988 found there were only three Chief executive officers among the Fortune 1,000, and women made up a mere 1.7% of the chief operating officers, chief financial officers, and executive vice presidents (Isaacs, 1995). A Stanford MBA graduating class was tracked over time and showed that 71% of the men held a position in the top four rungs of management whereas only 34% of

women had reached these positions (Isaacs, 1995). Although considerable gains have been made; women in managerial and professional positions has increased from 32% in 1983 to 50% in 2000, the infamous “glass ceiling” experienced by women remains firmly in place (Atwater, 2004).

Why does employment segregation exist? What makes an occupation male or female dominant? The sex ratios in occupations have been shown to strongly relate to the gender stereotypic images of the occupation (Cejka, 1999). Certain qualities are thought to be required in order to succeed in an occupation. These qualities correspond to the gender stereotype of either the male or female group that is numerically dominant in that occupation. Men and women hold different places in our social structure. They are expected to display gender-consistent behavior. For example men are expected to be assertive, confident, ambitious, competent, and dominant and women are expected to be helpful, kind, supportive, sympathetic, and sensitive (Atwater, 2004). These expectations lead to sex-typed occupations. Occupations where masculine characteristics are favored become numerically male dominated and occupations where female characteristics are favored become numerically female dominated. For example “masculine traits” are thought to be needed in order to be a successful manager; and statistics indicate that, managerial positions are male dominated (Atwater, 2004). Nursing is a profession dominated by females where “female traits” are thought to be more related to being a good nurse.

It is possible to achieve success as a member of the minority sex in a sex-typed occupation. However, there is often pressure to alter leadership style and display the characteristics that are inherent to the numerically dominant sex. This constant pressure

tends to have a negative impact on mental health (Gardiner & Tiggermann, 1999).

Frequently in male dominated occupations, women who achieve leadership positions feel frustrated due to feelings of limited power, having responsibility but no authority and, being less influential than their male counterparts (Luedtke, 1994). There are three consequences when women are in the minority that increases their stress level (Gardiner & Tiggermann, 1999). First, they are more visible to employers and co-workers and, therefore, attract a disproportionate share of attention which in turn creates greater performance pressures. Second, they feel isolated from the main male group. This isolation leads to a lack of formal support in operational decisions and the informal support that comes from the cohesion of being part of a team. The third consequence stems from sex stereotyping. When a woman utilizes a feminine leadership style in a male environment, because of the differences in leadership due to that style, she risks being seen as less successful or less competent. However, studies have shown that women, who utilize masculine leadership styles thus violating gender stereotypes, are judged as less competent and less effective than male leaders (Gardiner & Tiggermann, 1999; Atwater, 2004). When women behave in ways that are inconsistent with gender expectations their behavior is considered inappropriate and they are viewed negatively.

It has been suggested why employment segregation exists, how an occupation becomes male or female dominant and the problems that are faced by the minority sex in a sex-typed occupation. These topics will now be more thoroughly discussed with respect to the field of aviation and how it became a male dominated industry.

Gender Issues in the Field of Aviation

Women have been involved in aviation since its inception. E. Lillian Todd designed and built aircraft in 1906, and Helen Richey became the first woman pilot for a U.S. commercial airline in 1934 (Women in Aviation International, 2001). The number of women involved in aviation has steadily increased over the last two decades however the numbers still remain low with women representing a mere 6% of the pilot population, 12% of the Air Traffic Controllers, and 1.5% of the Aircraft Maintenance Technicians (Women in Aviation International, 2001). Over a twenty year period from 1964 to 1984 fewer than 145 female pilots were recruited. By 1984 Air France employed 3 female pilots and by 1995 British Airways employed only 40 women pilots out of a total of 3000 pilots which is less than 2% (Davey & Davidson, 2000). The sound of a women's voice in the cockpit, on the radio or in a crew room is still unusual. Women seldom make up more than 10% of the staff within an aviation company (Flygare, 2005).

The pilot role has been traditionally thought of as a masculine role. The perception that society has of an occupation as either male or female is established early and once established is very difficult to change. Aviation advancements occurred swiftly during the World Wars. The military flying image of a glamorous, daring, but slightly reckless fighter or test pilot became the popular view of pilots (Ramsey & Ramsey, 1996). Although the presence of women in the workplace has increased, women and men seem to have different roles with men on top and women on the bottom of the job hierarchy. For example, the role of the flight attendant is one that requires caring and is generally associated with women. The role of the pilot however, is one that requires leadership and technical skills and is generally associated with men (Flygare, 2005).

Within the aviation hierarchy, the pilot is in control of the aircraft and the flight attendant follows the aircraft Captain's orders. The perception that leadership and technical skills are inherent in men and are the attributes necessary to be a successful pilot is not the only point that leads to the male domination of the aviation industry. Early cockpit design tended to discriminate against women, with designs that placed devices out of their range for both reach and strength. These cockpit designs made piloting an aircraft physically demanding. Thus, the majority of women were physically unable to operate the aircraft which contributed to the male majority in the aviation industry.

The redesign of aircraft utilizing fly by wire airplanes with cockpit designs usable by the 5th to 95th percentile person have allowed more women into the pilot occupation. Aircraft devices are now within the majority of women's range for reach and strength, making women physically capable of flying the aircraft. However, the number of female pilots still remains small and, as minorities within the field of aviation, they are watched closely. Their performance in the cockpit seems more important than their male counterparts and they can be sure that if they perform poorly, it will not be forgotten (Flygare, 2005). Even though women are now physically capable of piloting an aircraft, women are still underrepresented as pilots; the traditional role of the pilot remains male dominated.

Some believe that to change the gender role associated with pilots it is as simple as the hiring of a lot of females (Ramsey & Ramsey, 1996). However, others feel that this influx of females is not the answer as it appears that the aviation culture is exerting its influence over the females in it, instead of vice versa (Davey & Davidson, 2000). That is to say, that instead of the females changing the aviation culture by adding

qualities that are labeled as female attributes, they are adapting to the aviation culture, and in an effort to be accepted, are assuming more male attributes. Merely increasing the number of female pilots may not facilitate the introduction of female attributes into the pilot occupation and thus eliminate the gender bias associated with the occupation. Researchers agree that once an occupation has been associated with one sex, it seldom changes (Flygare, 2005).

It has been established that the pilot occupation is a male sex-typed occupation. Some reasons that it remains a male dominated profession have been addressed. Thus far the discussion has focused on the inherent attributes that are deemed essential to be a successful pilot. However, biologically; factors might produce the justification for the perception.

Gender Differences in Aviation Related Biological Functions

With the expansion of women into the field of aviation, their experience base has grown and generated sufficient data to compare differences between men and women in the flight environment. The following is an overview of several biological functions and deficiencies that are likely to afflict one gender more than the other and how they relate to the flight environment.

Color blindness. The aviation environment demands accurate color discrimination during every phase of flight. Be it airport beacons, navigation lights or glass cockpit displays, interpretation based on color is necessary. Severe color blindness can, therefore, be a disqualifier during pilot selection. Color blindness is almost exclusively a male domain and is almost always in the red or green spectrums, two

critical colors in aviation (Howell, 2000). In the American population 8.5% of males suffer from color blindness versus only 0.5% of females (Tredici, 1996). Although in this area females appear to be more biologically suited to flying aircraft, color blindness does not slowly develop with age, it is present at birth and testing prior to pilot selection makes this advantage a moot point.

Presbycusis. This hearing loss is age-based and results in the deterioration of the middle and or inner ear. Although this impairment eventually affects everyone, men tend to become afflicted with it earlier and suffer greater losses (von Gierke & Nixon, 1996). Early onset of presbycusis is usually in the upper frequency range and is, therefore, not an immediate cause for pilot grounding (Howell, 2000). However, given the necessity for pilots to communicate both inside and out of the cockpit, any amount of hearing loss is a concern. Once again, females appear to have the upper hand in this biological area. But with a mandatory retirement age and yearly hearing exams, this biological advantage is nullified within the cockpit.

Decompression sickness. Pilots who operate at higher altitudes in unpressurized aircraft can become affected by decompression sickness or what is more commonly known in SCUBA as the “bends”. By 1959, over 17,000 aviation cases of decompression sickness were documented, 17 of which resulted in death (Heimbach & Sheffield, 1996). Research has shown that women are about four times more likely than men to show symptoms of decompression sickness (Howell, 2000). The United States Air Force School of Aerospace Medicine completed an 11 year review that indicated that women had an increased susceptibility associated with the onset of their menstrual period. Women within zero to four days of menstrual onset were five times more likely to

acquire symptoms of decompression sickness (Rudge, 1990) However, death from this sickness has all but been eliminated with the advent of recompression chamber therapy

Cardiovascular disease Within the American population both men and women are equally as likely to die of a heart attack (Howell, 2000) However, men are far more likely to suffer a heart attack at earlier ages Women are more likely to be stricken 20 to 25 years later With a mandatory retirement age and yearly physicals, the likelihood of a male having a heart attack while piloting an aircraft is negligible

Aerobic output at altitude Maximal aerobic power is a performance index that measures the respiratory and circulatory system's limit in delivering oxygen to active muscles and the ability of muscles to use that oxygen It is affected by any process that involves the chain of oxygen transport and use (Cymerman, Fulco, & Rock, 1998) When ascending to altitude, there is a decrease in atmospheric pressure This decrease in pressure modifies the oxygen gradient between the lungs and muscles (Cymerman, et al , 1998) Performance is, therefore, impaired when at altitude and this decrement varies in proportion to the duration of the activity Cymerman, Fulco, and Rock researched exercise performance data at altitude, specifically looking at the contribution of gender, aerobic fitness level, pre-exposure resident elevation, and duration at altitude Their research showed that fitness level differences caused the most variability and that gender differences caused the least Their data indicated that no difference existed between men and women in the percent of maximal aerobic power decrement with increasing altitude

Night vision goggle performance The invention and use of night vision goggles has enabled the Air Force to expand and carry out night operations The U S Army, Air Force, and Navy have been utilizing night vision goggles to assist during night warfare

on both ground operations and fixed wing as well as rotary wing air operations (Apsey, Ivan, Jackson, Mitchell, & Silberman, 1994). Apsey et al. utilized a large subject base composed of all aircrew to look at visual acuity with night vision goggles. They looked at the effects of variables such as age, gender, night vision goggle experience, spectacle wear, and smoking. Although corrective lenses and smoking did worsen the average visual acuity when wearing the goggles, age, night vision goggle experience and gender were not found to be factors.

Motion sickness. Motion sickness can occur when a person is exposed to certain kinds of real or apparent body movements. The symptoms can include cold sweating, nausea, and vomiting, all of which have a negative effect on flight performance (Hye-Young Park & Hu, 1999). Hye-Young Park and Hu (1999) investigated gender differences in motion sickness history and severity of symptoms in a real motion sickness-provoking condition. The results indicated that symptoms of motion sickness were not significantly different between men and women.

Research has shown that with respect to pilot competency, biologically males and females are equivalent. Therefore, the perception that males are more competent pilots than females does not stem from some biological superiority. Thus cognitively, factors should, be investigated.

Gender Influences on Fatigue and Aviation Related Cognitive Abilities

Fatigue. It is widely accepted that fatigue resulting from sleep loss results in a decrease of human performance. Sleep loss can cause slower reactions, cognitive ability decrement, and vigilance reduction (Caldwell & LeDuc, 1998). Both military and

civilian airline pilots often must work under fatiguing conditions that result from bizarre flight times, time zone changes and sleeping in hotels. Caldwell and LeDuc studied the responses of male and female aviators to the operational stressor of sleep deprivation in an effort to examine if these effects are more or less severe in women than in men.

Previous studies had shown gender differences in performance when sleep deprived.

However, these studies utilized elderly participants. The effects of sleep loss on job performance and mood of young men and women had not been studied. Caldwell and LeDuc examined the effects of sleepiness and fatigue on simulator flight performance, mood, and recovery sleep. Their participants consisted of male and female aviators with a mean age of 28.7 years. The participants were tested on flight performance and mood during 40 hour periods of sustained wakefulness. Both men and women suffered performance decrements as a function of sleep deprivation and both were equally aware of their own alertness difficulties as the sleep deprivation period progressed. However, the data gathered exhibited no significant differences between males and females. There were no gender main effects and no interactions between gender and sleep deprivation on any flight maneuvers. Males did show more tension and anxiety while females felt more vigorous during the sleep deprivation. However, this invigorated feeling felt by the females did not translate into superior performance (Caldwell & LeDuc, 1998). The results from this study indicated that the effects of sleep deprivation on simulated flight performance and cognition are not enhanced or diminished as a function of gender. Men and women are equally capable of cognitively enduring sleep deprivation effects in an aviation context.

Cognitive Abilities. Gilliland, Nesthus, and Schlegel (1999) looked at cognition for both genders without the stress of sleep deprivation. They studied the effects of an antihistamine, age and gender on selected cognitive tasks. These tasks included a dual task, tracking task, memory search task, manikin task, mathematical task, and a critical thinking task. The research indicated that gender had no main effects, although there were interaction effects along with age in the 50-55 year age group. Younger females and males showed equal performance; however, age had a greater detrimental effect on women. In an occupation with a mandatory retirement age and drug usage limitations, women are equally as capable as men of task performance.

These data suggest that there are limited biological or cognitive differences between males and females that would explain the perception that males are more competent pilots than females. Perhaps an investigation of pilot error may suggest that the perception is warranted.

Differences in Pilot Error Accident Rate

Flying is inherently dangerous; a mistake made 10,000 feet above the ground can have devastating consequences. Between the years of 1995 and 1999, general aviation aircraft crashes (private pilots) claimed an average of 652 lives annually; this accounted for 85% of all aviation deaths in the United States (Baker, Grabowski, Lamb, Li, & Rebok, 2001). The attitude exists within the aviation community that women do not belong in the cockpit. However, what do the statistics tell us? Are female pilots more dangerous than male pilots?

McFadden (1996) performed a study that looked at whether differences exist in the pilot-error accident rates of male and female US airline pilots. The results were based on data of aviation accidents collected during the years of 1986 to 1992. The conclusion from the study was that accident rates of males and females were not significantly different. Neither males nor females make for safer pilots.

Vail and Ekman (1986) completed a study aimed at analyzing the number and rate of pilot-error related accidents from 1972 to 1981 by gender. They utilized data from the national Transportation Board (NTSB) for their study. Vail and Ekman looked at the total number of United States Active Civilian General Aviation pilots. According to the NTSB files, during the years studied 37, 862 males and 967 females had accidents due to pilot error. Male student pilots had an accident rate that was 60% greater than for females during the ten years. Female student pilots had a lower accident rate than male student pilots for every one of the ten years. As well, female pilots with their private pilot's license had a lower accident rate than males for every year of the study. The average accident rate for female ATP certified and commercial pilots was 31% versus 50% for males; again the accident rate was lower for females than for males during each year of the study. Combining all of the pilot certifications the average yearly accident rate was 23% for females and 52% for males. The difference in accident rates was significant for all ten years. The fatality rate for males in pilot error accidents was twice that for females. Female accident rates were lower in all phases of flight except for taxiing. In conclusion, Vail and Ekman stated that males had a higher rate of accidents than females and a higher portion of the male accidents resulted in fatalities or serious injuries.

A more recent study looked at identifying the differences between male and female pilots in the circumstances of their crashes and the types of pilot errors involved (Baker, Lamb, Grabowski, Rebok & Li, (2001). Since youth and inexperience are well-known contributors to aviation crashes this study utilized mature pilots age 40 years or older. Their research again showed that crash rates of general aviation pilots were significantly higher for male pilots than for female pilots. Baker, et al. (2001) found that the most common cause of crashes was loss of control during take-off or landing. Errors during this phase of flight accounted for 59% of female accidents and 36% of male accidents. The most common type of pilot error that was made during these crashes was a mishandling of aircraft kinetics (e.g. incorrect use of rudder, inability to recover from a stall) for female pilots and flawed decision-making or inattention for male pilots (Baker, et al., 2001). Women were more likely to crash as a result of stalling or mishandling the controls during take-off or landing, and men were more likely to crash due to poor pilot judgment such as running out of fuel, or risking flying in poor weather or with a faulty aircraft.

The statistics clearly indicate that female pilots are as safe, if not safer, than male pilots. The belief that female pilots are not as competent as male pilots does not appear to be supported by past research. The belief must then stem from an inaccurate perception that people have of female pilots.

Gender and the Perception of Competence

In a work environment competence is key, but when one has the safety of others in one's hands, such as is the case for airline pilots, competence becomes crucial. What

is competence based on? Is it purely a measure of skill and level of achievement?

Research has shown that characteristics of a pilot such as gender and experience can affect the opinions of passengers about the competence of the pilot. Stereotypes about pilots cloud an individual's judgment of competence. A study conducted by Davey and Davidson (2000) quoted male Captains as agreeing that they observed female co-pilots a little more closely than their male counterparts. Another study by Chambers (1984) cited managers' beliefs that passengers would be too scared with a female at the controls, as a reason for refusing flying jobs to women. Clearly the perception of competence is not based on objective criteria.

Men and women both tend to rate a man's performance more favorably than a woman's performance, even when their performance is actually identical (Hasuike, 2000). This is true unless the area of expertise that is being considered is regarded as a female domain such as child rearing, domestic tasks or feeling-oriented interpersonal tasks; here women are seen as being more competent than men. For example, a female advocate is perceived as being more competent when litigation involves family issues whereas a male advocate is perceived as being more competent when litigation is technical or complex (Hasuike, 2000). A study conducted by Goldberg (1968) presented subjects with journal articles that were identical in all respects except for the author. One version of the article was attributed to a male author and the other version was attributed to a female author. The participants were asked to evaluate the article on scientific contribution, writing style, and other indicators of worth. The results showed a bias in which participants gave the male author a better review than the female author. In

summary perception is not only dependent on the gender of the person being judged but also on the gender stereotypic images of the occupation.

Etaugh, Houtler, and Ptasnik (1988) conducted a review of Goldberg's research and showed that males are evaluated higher than females for the same performance and that the professional status of the person being evaluated can alter the evaluation. Etaugh and Sanders (1974) completed a study where male and female participants were asked to evaluate artwork. The results showed that the ratings were higher when the artist was male. However, if the work had won a prize in a contest there was no difference between the ratings for the male and female artists. The results showed that the raised status of the art afforded by the prize, mediated the effects of gender. They also found that when a female performed beyond the evaluators' expectations, she tended to be rated more favorably than an equally performing male.

Support for these findings can be found in a study by Dukes, Hulbert-Johnson, Newton and Overstreet (1991) that examined the effects of gender, experience, and performance of a commercial aviation pilot on the concern of the passengers about flying with him or her. The study investigated the stereotypes about being a newly promoted female airline captain on estimates of pilot competence. The results showed that the effect of gender and performance on the level of apprehension was statistically significant. When a landing was poor, the participants were more concerned with continuing on the same flight when the pilot was a female than when the pilot was a male. However, when the landing was good, the participants showed more concern for continuing the flight when the pilot was male than when the pilot was female. This study supported the findings from Etaugh and Sanders (1974) that stated that when a female

performed beyond the evaluators' expectations she tended to be rated more favorably than an equally performing male

Statistics have shown that females are just as safe, if not safer, than male pilots. However, long ago during aviation's inception male characteristics were believed to be the assets required to be a successful pilot. These beliefs lead to a gender stereotypical image of the occupation. Piloting became known as a male domain. As women gained access into the world of aviation, they worked hard to become skillful, adept pilots. Although the evidence indicates that women have met and exceeded the performance required to become pilots, the perception still remains that males are more competent pilots than females.

This review of literature suggests that neither biological differences, cognitive differences nor accident rate statistics can provide evidence that males are more competent pilots than females. Yet this perception persists in the aviation community. An explanation for why this perception persists may be accounted for by social theories of gender.

Relevant Social Psychology Theories of Gender

Historical perspective For a long period of time the development of sex-roles was focused on Freud's description of the family with the mother providing the feminine virtues of love and nurturance and the father the masculine strengths of rules and discipline (Fagot, Rodgers & Leinbach, 2000). In Freud's opinion, the development of sex-roles was a function of the biological sex of the child rather than socialization differences. His theory was derived from the memories of adults rather than the

observation of children. It depended upon the development of sexual rather than social gender roles (Fagot et al., 2000). Soon researchers began using insights from psychology and sociology to emphasize the social rather than the biological roles in family socialization. They reworked Freud's ideas and developed a social learning theory (Fagot et al., 2000).

The social learning theory contends that children's sex-role identification took place through modeling and reinforcement. It looked at three types of learning; classical conditioning, learning emotional reactions to gender-related behaviors; operant conditioning, rewarding and punishing people to be male or female; and modeling and observational learning, imitating gender-related behaviors in others (Fagot et al., 2000).

In the 1970s, a review of the studies involving sex differences was conducted and the conclusion was that families showed few disparities in the treatment of boys and girls (Lytton & Romney, 1991). This new research that failed to find socialization differences between boys and girls brought about a decline in socialization research and the focus turned to children's self socialization through their own cognitive processes (Fagot, et al., 2000).

Kohlberg and Zigler (1967) developed a cognitive development theory tying sex-role development to Piaget's stages of early cognitive development. They posited that behaviors were based on development of cognitive abilities. They argued that children did not passively absorb gendered information from their environments; children were actively involved in learning about gender. First, children would develop gender labeling. They had knowledge that two sexes existed and they used cues such as dress or hair to apply labels to themselves and others. Next, they would develop gender

constancy. They understood the permanence of gender and began to develop gender appropriate attributes. Finally, the children developed gender identity. Their thinking became more logical and their sex-typing more rigid.

In the late 1970s, research was refocused onto category structure and formation (Fagot, et al., 2000). A category is said to exist whenever two or more different entities are treated equivalently. In 1981, Bem proposed a gender schema theory in which children were seen as taking in and organizing environmental input schematically by categorizing information. While social learning theory and cognitive developmental theory emphasized how the process of sex-typing occurred, Bem's gender schema theory looked at what was learned and the functional significance of gender categories within society. Bem stated that the developing child learned content-specific information about the particular behaviors and attributes that are linked with sex. Schema theories provided new perspectives for understanding gender development. Instead of focusing on the nature of the environment, schema theorists considered the strategies that individuals used to interpret information from their environment (Martin, 2000). Schema theories provided information for findings that otherwise were difficult to explain, such as how stereotypes are maintained even in the face of disconfirming evidence and why these stereotypes are so difficult to change.

A schema is "a cognitive structure, a network of associations that organizes and guides an individual's perception" (Bem, 1981). Stereotypes are the functional equivalent of schemas. The proposal of schemas as a construct for understanding how information is perceived and organized has gained wide acceptance (Hudak, 1993).

Gender schema theory. Bem's (1981) gender schema theory proposes that sex typing originates from gender-based schematic processing. This schematic processing can be described as a readiness to process information on the basis of sex-linked associations that comprise the gender schema. Some examples of these sex-linked associations that directly relate to men and women are anatomy, division of labor, and personality attributes (Bem, 1981). The gender schema theory also proposes that we not only learn this content specific information but that we also learn to use this network of sex-linked associations to evaluate and assimilate new information (Bem, 1981). That is to say that we learn to process information in terms of our gender schema; what we perceive is actually a product of the incoming information and our preexisting schema.

Bem's gender schema theory classifies people into two groups, those who are gender schematic and those who are gender aschematic. A person who is gender schematic will be more aware of people who deviate from their socially constructed gender role. They will treat people according to their sex. These sex-typed individuals, who are termed gender schematic, tend to organize information about themselves, others, objects, and events on the basis of gender associations instead of the available categorical information (Edwards & Spence, 1987). Non sex typed individuals, termed gender aschematic, have neither masculine nor feminine in their sex role identity and are relatively unresponsive to stereotypes. Gender aschematic individuals are less reliant on gender schema and are better able to appreciate individuating information (Hudak, 1993).

Research has been shown to support the importance of gender schemata in the development of gender roles (Cann & Garnett, 1984; Cann & Haight, 1983; Cann & Newbern, 1984; Levy & Carter, 1989; Liben & Signorella, 1980). Research that supports

gender schema theory involves comparisons of schematic versus aschematic individuals and includes; tests of the likelihood of clustering during recall (Bem, 1981), tests of the readiness to process information about the self in terms of gender (Forback, Evans, & Bodine, 1986; Markus, Crane, Bernstein, & Siladi, 1982; Mills, 1983), tests of tendency to encode and organize information in terms of gender (Anderson & Bem, 1981; Aronoff & McCormick, 1990; Bem, 1981; Deaux & Major, 1977; Frable & Bem 1985; Lippa, 1977; Lippa, 1983), tests of preference for sex appropriate activities (Bem & Lenney, 1976), and tests of the availability of both nurturance and independence in behavioral repertoires (Bem, 1975; Bem, Martyna, & Watson, 1976).

Once a gender schema is formed, it becomes a lens through which people process information and it strongly influences thoughts, feelings and behaviors (Ester, 2003). This stereotypical thinking works against the use of individuating information. Instead of assessing a situation solely on the information presented, the situation is assessed based on the information as well as the pre-conceived gender schema. But how does one determine if they are gender schematic or gender aschematic? How is gender schema measured? In adult literature, personality measures such as the Bem's Sex Role Inventory (BSRI) have been used more than other types of measures to determine gender schema (Martin, 2000).

Bem's sex role inventory (BSRI). Bem (1979) based the development of the BSRI on the gender schematic theory which states that schematic individuals are more cognitively dependent on gender, compared with aschematic individuals who are cognitively more adaptable. Bem (1981) differentiated individuals according to the extent that they categorize and interpret information with respect to the basic categories

of masculinity or femininity. The BSRI includes twenty feminine characteristics, twenty masculine and twenty neutral. The two scales of femininity and masculinity were developed by asking men and women to identify these attributes in terms of their desirability for each sex (Hudak, 1993). Individuals taking the BSRI rate themselves as possessing a characteristic on a scale from one to seven. When averaged, the median score is 4.5. Unlike other tests, an individual may score high, or low on both the feminine and masculine scales because they are scored separately. Individuals who score high (above 4.5) on both masculine and feminine scales are said to be androgynous and individuals who score low (below 4.5) on both of the scales are said to be undifferentiated (Bem 1981). In both of these situations the individual is said to be non sex typed or gender aschematic and is expected to display gender-role adaptability across situations (Hannover, 2000). Individuals who score high on either the masculine or the feminine scales, but not both, are said to be gender schematic or sex typed and are expected to categorize social information according to its gender appropriateness and are therefore limited in their behavior in accordance with their self-definition as masculine or feminine (Hannover, 2000).

The appropriate question here is how well does the BSRI successfully identify individuals' schematicity? A study conducted by Larsen, Randy, Seidman and Edward (1986) assessed whether the BSRI and the Personality Research were appropriate tests to be used when investigating the gender schema theory. Responses to both tests by 561 male and female participants were analyzed separately for sex-typed and non- sex-typed groups. The results showed theoretically consistent differences in the factor solutions of the two groups. The results supported the construct validity of the BSRI for use in

researching the implications of this theory. The construct validity of the BSRI has been examined by several researchers and has been found to be valid (Gaa, Liberman & Edwards, 1979; Marsh, 1985; Blanchard-Fields, Suhrer-Roussel & Hertzog, 1994). Most social psychologists agree that the perceptions that an individual has of themselves will influence the perceptions that they have of others (Markus, Smith & Moreland, 1985). It is, therefore, logical that if one's perception of their self is more masculine or feminine that this to will have an impact on how they perceive others (Markus et al., 1985).

Purpose of the Current Study

The current study utilized the method developed by Goldberg (1968) and utilized by Duke, Hulbert-Johnson, Newton and Overstreet (1991) in their study of the experience and gender bias concerning pilots. This procedure was originally used to uncover the differential evaluation of males and females during identical job performances on written tasks. In the original experiment, the subjects were given a journal article that was identical in all aspects except the authorship. One version was attributed to a male author and the other version was attributed to a female author. Participants were told to evaluate the article on scientific contribution, writing style and other indications of worth. The results from the study showed a bias in which participants favored the male author over the female author. Subsequent studies have extended this technique to look at the evaluation of works of art, the admission of a student to graduate school and the evaluation of a lawyer (Dukes, et al., 1991).

This study extended the work by Dukes, and colleagues, (1991) and Paulsen (2002). Dukes, and colleagues utilized the Goldberg technique to study the effects of

gender, experience, and performance of a commercial aviation pilot on the concern of passengers flying with the pilot. Paulsen (2002) utilized the Goldberg technique to investigate the perceived competence of male and female pilots in identical scenarios as judged by both male and female instructor pilots.

This study looked at the effect of gender schematicity of the participants and gender of the pilot on the participants' perceived competence of the pilot. It was expected that the results from this research would add to this area of investigation by providing support for the conclusion that male and female pilots may be perceived differently while in the same situation and displaying the identical level of skill and ability. It was also expected that the results would support the findings of Bem (1981) who claimed that gender schematic individuals would utilize gender-based schematic processing to evaluate the scenarios. They would, therefore, display a difference in the perceived competence of the pilot depending on the pilot's gender. In contrast, gender aschematic individuals would not utilize a gender-based schematic process. Instead, they would evaluate the scenarios based on the information provided and would therefore not display a difference in the perceived competence between male and female pilots displaying identical levels of skill and ability.

Research involving gender bias is important. If research indicates that members of a social category are disadvantaged, then steps must be taken to rectify this situation. Understanding the social and psychological behavior behind gender biasing is imperative to developing a solution to the problem. This study contributes to and provides a basis for continued research in this area which will further clarify the understanding and the

implications involved in gender biasing. In addition, it provided insight into the challenges that are currently faced by women in aviation.

Statement of the Hypotheses

Since its inception, aviation has been a male dominated profession. As such masculine attributes are thought to be required in order to be a successful pilot. According to Bem's gender schema theory, schematic participants will view female pilots as deviating from their socially constructed gender role. These participants will utilize the situational information as well as their pre-existing gender schema to evaluate a given scenario. Additionally, according to Bem's gender schema theory, aschematic participants will evaluate scenarios based on categorical information and will be unaffected by stereotypes.

Three hypotheses were tested. The first hypothesis examined the main effect of the gender of the pilot in the scenario. It was hypothesized that the results from this study would support Goldberg's (1968) and Duke, Hulbert-Johnson, Newton and Overstreet's (1991) findings. Given that the piloting profession is viewed as a male domain, participants should give a higher perceived competence rating for the male pilots than for the female pilots. The second hypothesis examined the main effect of the schematicity of the participants. It was hypothesized that the results from this study would support Bem's Gender Schema Theory. Schematic participants should utilize the given information while also drawing from their pre-existing schemas to assess the piloting scenario. Aschematic individuals should only utilize the given information to assess the piloting scenario. It was hypothesized that schematic participants would give a higher

perceived competency rating to the pilot in the scenario then aschematic participants

The third hypothesis examined the interaction effect between the gender of the pilot in the scenario and the schematicity of the participants. It was hypothesized that schematic participants would give male pilots in the scenario higher perceived competency ratings than the female pilots in the scenario. Aschematic participants would show no difference in perceived competence between male and female pilots.

Method

Participants

The participants consisted of Flagler College and Embry-Riddle Aeronautical University (ERAU) students enrolled in an undergraduate Introduction to Psychology class. All participants were literate in the English language and had flown on a commercial airliner. The participants were not aware of the exact focus of the study to avoid biasing answers to those deemed more socially desirable.

Materials

A statement of consent form (appendix A) was read and signed by each participant. A pencil and paper version of the BSRI was constructed (appendix B). The BSRI was scored utilizing the approved score sheet (appendix C). Based on the results of the BSRI one of three paper based scenarios was assessed by the participant (appendix D). All three scenarios depicted a situation in which a pilot who was flying a commercial airliner experienced adverse conditions, but still completed a successful landing. The scenarios differed only in that the Aircraft Captain was either a male, female, or

unspecified gender. This was achieved by varying the name of the Captain in each scenario.

The assessment of the participants' perceived competence of the pilot was documented on a paper based questionnaire called the Perceived Competence Scale (PCS) (appendix E). The Perceived Competence Scale is a short questionnaire that research in domains other than aviation has shown to be a good measure of perceived competence (Williams, Freedman & Deci, 1998, Williams & Deci, 1996). The PCS is specifically designed to be adaptable to the domain or behavior being studied. The questions were developed utilizing a non-specific gender name for the Captain. Responses for the questions were in the form of a Likert scale with a low score of 1 and a high score of 7. The use of this scale provided continuity and stability and allowed for a quantitative analysis of the responses. The questionnaire was also utilized as a platform for collecting demographic information such as participant: age, sex, apprehension about flying on a commercial airline, how often they fly, and if they were a licensed pilot.

Design

There were two independent variables in this experiment. The first independent variable was the gender of the Aircraft Captain in the scenario with three levels (male, female, and unspecified). The participant group that received the unspecified gender scenario was utilized as the control group. The second independent variable was the gender schematicity of the participants with two levels (gender schematic, and gender aschematic). Both independent variables were between-subject variables.

The dependent variable was the assessment of the scenario Aircraft Captain's competency. This was measured utilizing the Perceived Competence Scale (PCS) and therefore had fixed responses.

A 3 X 2 between subjects, fully factorial ANOVA strategy was used to look for a main effect due to the gender of the pilot in the scenario, a main effect due to the schematicity of the participants, and an interaction effect between participant gender schematicity and gender of the Captain in the scenario.

A between subjects design was utilized to prevent the practice effect that would occur if participants were to see all three scenarios. The control group provided perceived pilot competence scores when no gender was indicated. This control group provided scores to compare with the experimental group scores.

Procedure

The experiment consisted of two sessions approximately 10 minutes each in length. During the first session participants were given a packet containing a consent form and a BSRI questionnaire. Participants were given standardized instructions. They were asked to sign the consent form before beginning the BSRI. Upon completion of the BSRI, the surveys were collected by the experimenter. This concluded the first session. The experimenter then scored the questionnaire in accordance with the score card contained in appendix C. In accordance with Bem (1981), a score of 4.5 or higher on the feminine and or masculine scale was considered "high". Therefore the following four categorizations for participants were possible:

1. Schematic. This assignment occurred when a participant received a high feminine score (4.5 or higher) and a low masculine score (less than 4.5).
2. Schematic. This assignment occurred when a participant received a low feminine score (less than 4.5) and a high masculine score (4.5 or higher).
3. Aschematic (Androgynous). This assignment occurred when a participant received a high feminine score (4.5 or higher) and a high masculine score (4.5 or higher).
4. Aschematic (Undifferentiated). This assignment occurred when a participant received a low feminine score (less than 4.5) and a low masculine score (less than 4.5).

Upon completion of scoring the BSRI, participants were either assigned to the Schematic or Aschematic treatment groups. Participants were then randomly assigned one of the three scenarios ensuring an equal number of male, female, and unspecified scenarios were assessed for each treatment group upon completion of the experiment.

During the second session, participants were asked to read the scenario and complete the prepared questionnaire on their perceived competence in the pilot and demographic information (appendix E). Participants were assured that their answers to the questionnaire were confidential. After the responses had been collected, participants were read the debriefing form (appendix F), were asked to place all materials back into their packets and were thanked for their time and participation.

Results

Pilot Study

A pilot study was conducted to ensure that the assessment tools utilized would be sensitive enough to identify the differences hypothesized. The participants consisted of 11 schematic and 20 aschematic individuals. A total of 25 males and 6 females were tested. The participants that were utilized were ERAU undergraduate students enrolled in an Introduction to Psychology class. The average age of the participants (with standard deviations in parentheses) was 20.06 (2.37) years. All participants were literate in the English language and had flown on a commercial airliner. The participants were not aware of the exact focus of the study to avoid biasing answers to those deemed more socially desirable. Table 1 depicts the means and standard deviations for each experimental condition.

Table 1. Average pilot competency scores (pilot study).

Schematicity	Male		Pilot Gender Female		Unspecified		Total	
	M	SD	M	SD	M	SD	M	SD
Schematic	32.00	2.65	25.75	8.54	29.50	4.79	28.82	6.09
Aschematic	24.38	4.98	23.50	9.05	26.33	6.06	24.70	6.46
Total	26.45	5.61	24.40	8.44	27.60	5.54	26.16	6.54

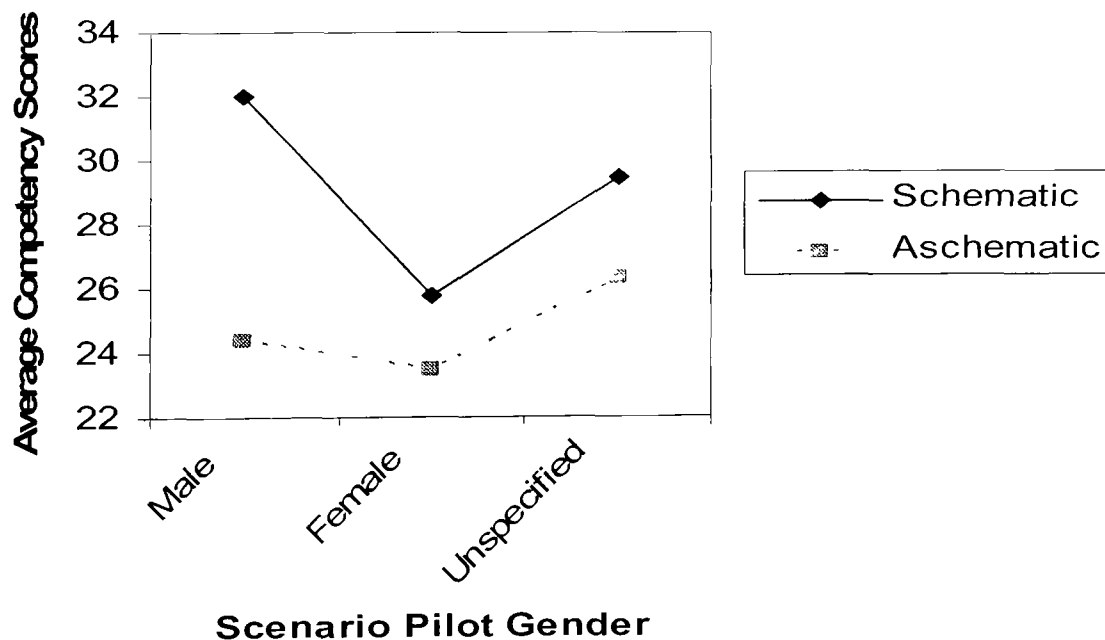
The results of the 3 X 2 ANOVA are displayed in Table 2 and Figure 1 presents a graphical representation of the means for each condition. An alpha level of .05 was used for all statistical tests.

Table 2. Analysis of variance for average pilot competency scores (pilot study).

Source	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	Eta Squared	Observed Power
Schematicity	131.679	1	131.679	3.081	0.091	0.110	0.393
Scenario	74.050	2	37.025	0.866	0.433	0.065	0.182
Schematicity* Scenario	37.269	2	18.634	0.436	0.651	0.034	0.113
Error	1068.458	25	42.738				

For $\alpha = .05$

Figure 1: Average competency ratings by pilot gender and participant schematicity (pilot study)



The main effect of the gender of the pilot in the scenario was not statistically significant, $F(2,25) = .866$, $p = .433$, nor was the main effect of the participants' gender schematicity statistically significant, $F(1,25) = 3.081$, $p = .091$. The statistical analysis looking at the interaction effect of the gender of the pilot in the scenario and the participants' gender schematicity was also not statistically significant, $F(2,25) = .436$, $p = .651$.

Although the pilot study failed to reveal significant results with respect to the main effects and the interaction effect, this is not surprising as the number of participants utilized in the pilot study was small. The results were, however, encouraging with the data indicating differences that supported the hypotheses. The first hypothesis suggested that the male pilots would receive higher average competency ratings than the female pilots. The results from the pilot study supported this, with male pilots receiving average competency ratings of 26.45 (5.61) and female pilots receiving average competency ratings of 24.40 (8.44). The second hypothesis suggested that the schematic participants would give higher average competency scores than the aschematic participants. The results from the pilot study supported this with schematic participants giving average competency ratings of 28.82 (6.09) and aschematic participants giving average competency ratings of 24.70 (6.46). The third hypothesis proposed that schematic participants would give higher average competency ratings for male pilots than for female pilots while aschematic participants would rate the male and female pilots' competency as equal. Again, the pilot study supported this hypothesis, with schematic

participants giving average competency ratings of 32 (2.65) and 25.75 (8.54) for male and female pilots respectively and aschematic participants giving average competency ratings of 24.38 (4.98) and 23.50 (9.05) for male and female pilots respectively. The effects were in the hypothesized direction for all cases. Therefore, a complete study was conducted using the same exact parameters detailed in Method section.

Experiment

The experiment was conducted both at Flagler College and ERAU in an effort to have the large sample size that was predicted as necessary by a power analysis. At Flagler College, 81 individuals were tested and 72 were randomly selected for analysis. The 72 selected participants included 36 schematic and 36 aschematic individuals. Twenty four male, female, and unspecified gender scenarios were assessed (evenly distributed between the schematic and aschematic participants). At ERAU, 145 individuals were tested and again 72 were randomly selected for analysis ensuring the same above mentioned ratios were maintained. The participants were all undergraduate students who were enrolled in an Introductory Psychology course at their respective schools. In total, 144 participants were tested and analyzed. Their average age was 20.38 (2.31). The group consisted of 89 male participants and 55 female participants. All participants had flown on a commercial airliner while 40 of the participants were either licensed pilots, or student pilots. Table 3 depicts the means and standard deviations for each experimental condition.

Table 3. Average pilot competency scores (experiment).

Schematicity	Male		Pilot Gender Female		Unspecified		Total	
	M	SD	M	SD	M	SD	M	SD
Schematic	24.83	4.49	25.46	5.82	25.04	6.15	25.11	5.46
Aschematic	25.67	5.18	26.38	6.28	26.67	5.09	26.24	5.48
Total	25.25	4.82	25.92	6.01	25.85	5.65	25.67	5.48

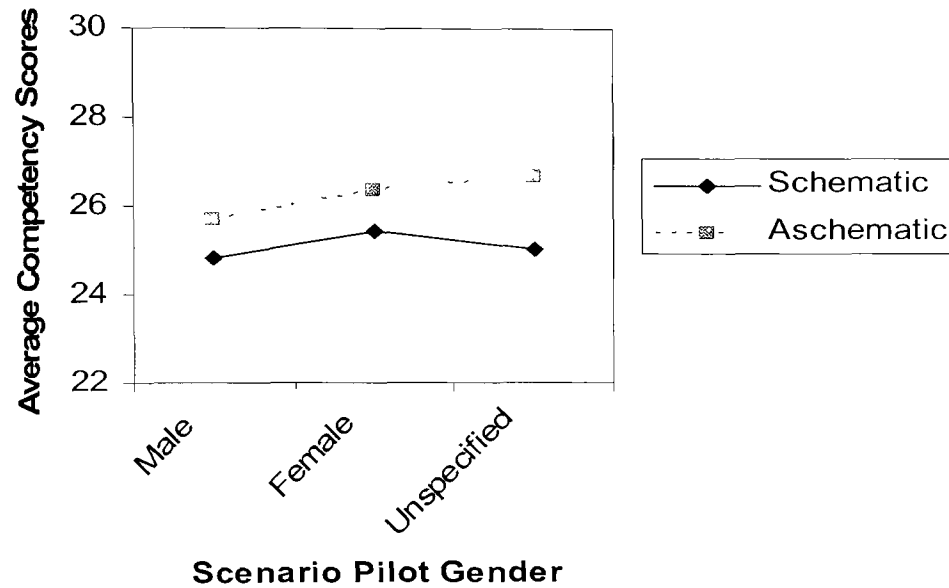
The results of the 3 X 2 ANOVA are displayed in Table 4 and Figure 2 presents a graphical representation of the means for each condition. An alpha level of .05 was used for all statistical tests.

Table 4. Analysis of variance for average pilot competency scores (experiment).

Source	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	Eta Squared	Observed Power
Schematicity	45.563	1	45.563	1.484	0.225	0.011	0.227
Scenario	13.014	2	6.507	0.212	0.809	0.003	0.083
Schematicity* Scenario	4.542	2	2.271	0.074	0.929	0.001	0.061
Error	4236.542	138	30.700				

For $\alpha = .05$

Figure 2: Average competency ratings by pilot gender and participant schematicity (experiment)



The main effect of the gender of the pilot in the scenario was not statistically significant, $F(2,138) = .212$, $p = .809$, nor was the main effect of the participants' gender schematicity statistically significant, $F(1,138) = 1.484$, $p = .225$. The statistical analysis looking at the interaction effect of the gender of the pilot in the scenario and the participants' gender schematicity was also not statistically significant, $F(2,138) = .074$, $p = .929$.

Discussion

The piloting profession is a male dominated domain in which masculine attributes are considered to be required in order to be successful. The first hypothesis tested, looked for a main effect of the gender of the pilot in the scenario. In accordance with past literature (Goldberg, 1968, Dukes, Hulbert-Johnson, Newton and Overstreet, 1991) it was expected that male pilots would receive higher average competency ratings than female pilots. The second hypothesis looked for a main effect of the schematicity of the participants. It was expected that the results from this study would support Bem's Gender Schema Theory and that schematic participants would give a higher average competency rating to the pilot in the scenario than the aschematic participants. Lastly, the third hypothesis looked for an interaction effect between the gender of the pilot in the scenario and the schematicity of the participants. It was hypothesized that schematic participants would give male pilots in the scenario higher average competency ratings than the female pilots and that the aschematic participants would show no difference in their perceived competence between male and female pilots.

Although the pilot study did not yield significant results, the outcome was encouraging in that the two main effects and the interaction effect were in the desired direction of the three hypotheses. Considering the small sample size that was utilized in the pilot study, the non-significant results were not surprising. Given that the results showed effects in the desired direction, it was felt that the scenarios and scales utilized in the study would be sensitive enough to detect the differences being studied and were therefore utilized during the experiment.

Although the pilot study produced some encouraging results, the outcome of the experiment involving 144 participants did not yield significant results in either of the main effects or the interaction effect. A power analysis was conducted prior to the experiment which indicated that 122 participants would be required. Given that 144 participants were utilized and the resulting power from the statistical analysis remained low, it is felt that the lack of significant results most likely does not stem from utilizing too few participants but may lie in the scales and scenarios that were employed in the experiment. The following will discuss the scales, and scenarios utilized in the study and will provide four possible explanations for why the experiment data did not generate support for the hypotheses. Suggestions for future considerations in this area of research will also be discussed.

One reason for the lack of an effect in this study could be the use of the Perceived Competency Scale. The PCS was developed specifically to be adaptable to any domain being studied. It has often been used to show differences in a person's feelings of competence about their ability to control their health, their ability to play a sport, or their ability to complete a college course (Williams, Freedman & Deci, 1998, Williams & Deci, 1996). The PCS has not been commonly used to assess an individual's perceived competence in someone else. It is, therefore, possible that the claim of the adaptability of the PCS does not extend to the judgment in competency of someone else. The scale may be sensitive enough to detect differences between individuals' competency assessments of themselves but not their perceived competency of others. This study utilized the PCS as a tool for participants to express their perceived competency in a pilot involved in a specific flight scenario. The PCS's greatest advantage is its claim of adaptability. The

results from the pilot study appeared to support the adaptation of the PCS into an aviation format. However, given the lack of research utilizing the PCS to assess the competency of a third person, it is possible that this scale was not sensitive enough for use in this study. Future research should consider the use of other valid scales for assessing the competency of a person in a given scenario.

A second possible contributing factor to the lack of significant results could have been the piloting scenarios that were presented to the participants. It is feasible that manipulating the gender of the pilot in the scenario only by varying the pilot's name was not a strong enough manipulation to see differences in the ratings of competency. Participants could have read the scenario and answered the questionnaire but never really absorbed the gender identity of the pilot. Paulson's (2002) research utilized similar scenarios. Although her results revealed significance in several minor areas, her overall results tended in the direction of her hypotheses but did not yield significant results. Paulson did not address the scenarios as a possible reason for her lack of results as her main focus was on the small number of participants that she utilized. It is possible that the similar scenarios used in her study also provided a weak manipulation, contributing to the lack of significant results. In a study conducted by Dukes, Hulbert-Johnson, Newton and Overstreet (1991) this same method for varying the gender of the pilot in the scenario was utilized. Once again the main effects involving gender tended in the direction of the hypotheses but did not yield significant results. However, the interaction effects involving gender did yield significant results. This research also did not discuss the possibility that the scenario used created a weak gender manipulation. Future research should look to find other methods of reinforcing the gender identity of the person being

assessed. However, caution must be taken to ensure that it does not become obvious to the participant that gender is the main focus of the experiment.

A third possible contributing factor to the lack of significant results also looks at the flight scenario that was presented. It is feasible that the scenario did not clearly illustrate that the pilot's competency was questionable. The potential exists that readers blamed the poor landing on the weather and attributed an overall successful landing to a competent pilot. It could be that a scenario illustrating a clearer case of questionable pilot competency would have made for a stronger manipulation. However, care must be taken as a scenario displaying much poorer pilot proficiency could skew the data to the lower end of the Likert scale.

Lastly, the lack of significant results could stem from the common knowledge that pilots must complete very rigorous and standardized training before becoming airline pilots. Since the pilot in the scenario had obviously completed this training and had been promoted to the level of Aircraft Captain, participants may have viewed this scenario as one poor landing with weather as a contributing factor. This may not have been observed as enough evidence to question the Captain's competency. Future research should consider having participants assess a co-pilot's performance who is still in training or a student pilot. Utilizing a pilot who has not completed all of the required training and has, therefore, not proven his/her competency at piloting an aircraft may allow the participant assessing the scenario more freedom to question the pilot's competency.

Summary

Gender is a very significant category in social life. The evaluation of women working in male dominated work environments could prove to be inaccurate if the assessment is completed by a person with a biased perception.

This study looked at women in the field of aviation or more specifically as a pilot in command of an aircraft. Possible reasons for the perception that male pilots are more competent than female pilots were discussed. A review of the literature in the areas of aviation related biological functions, aviation related cognitive abilities, and differences in pilot error accident rates did not appear to contain evidence that would suggest why there is a difference in the perception of competence. A review of social theories of gender attempted to explain why this perception exists.

In conclusion, a study based on Goldberg's technique (1968) was proposed that utilized Bem's Gender Schema Theory and her developed Sex Role Inventory (1981). The suggested study looked at the effect of an individual's schematicity and the gender of a pilot in a given scenario on the individual's assessment of the pilot's competence as evaluated using the Perceived Competence Scale. The results from this study did not yield significant results. Given the extensive research on Bem's Gender Schema Theory, the current statistics of women in male dominated occupations, as well as Goldberg's (1968) and Dukes, Hulbert-Johnson, Newton and Overstreet's (1991) studies that indicated the presence of a gender bias when evaluating men and women in like scenarios, it is probable that this bias exists. It is also believed that if the current study utilized a scenario that placed a greater emphasis on the gender of the pilot being assessed, utilized a slightly more extreme demonstration of poor piloting, and employed a

less experienced pilot, significant results would have been achieved. The results from this study contributed to this area of research by furthering the understanding of gender research in aviation. Paulson's recommendations were implemented into this design and new recommendations were made for consideration in future research. It is by slowly making progress with research that it can be shown that female and male pilots are perceived differently while in the same situation and displaying the identical level of skill and ability. Once the presence of this bias can be demonstrated, then steps can then be taken to correct the situation and improve the field of aviation for everyone.

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Appendix A

Consent Form

Study Conducted by Jan Laplante
 Chair: Dr. Shawn Doherty
 Embry Riddle Aeronautical University
 Human Factors and Systems
 Daytona Beach, FL. 32118

The experiment you are about to participate in is designed to investigate the relationship between personal characteristics and the perception of competence. The experiment consists of two, 10-minute sessions. During the first session you will be asked fill out a Bem Sex Role Inventory list. During the second session you will be asked to read a flight scenario and then answer a questionnaire pertaining to that scenario. You will also be asked to provide some general demographic information. Please do not communicate with other participants or read another participant's materials while the study is being conducted.

There are no known risks associated with this experiment. Please be assured that any information that you provide will be held in strict confidence by the researcher and at no time will your name be reported along with your responses. Please understand that your participation in this research is voluntary and you may withdraw at any time.

At your request, you will receive a report of the results upon completion of the study. Thank you for your participation. If you have any questions, please ask during the experiment or feel free to call me at (386) 763-2581 or contact my thesis Chair at (386) 226-6249.

Statement of Consent

I acknowledge that I have been informed of the general purpose of this study. I acknowledge that my participation in this study is entirely voluntary and that I am free to withdraw at any time.

Signature of Participant: _____ Date: _____

I would like to receive a report of results from this experiment: yes ____ no ____

Appendix B

Bem's Sex Role Inventory

Rate yourself on each item, on a scale from 1 (never true) to 7 (always true).

- | | | | | | | | |
|----------------------------|------------|---|---|---|---|---|-------------|
| 1. self reliant: | never true | | | | | | always true |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. yielding: | never true | | | | | | always true |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. helpful: | never true | | | | | | always true |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. defends own:
beliefs | never true | | | | | | always true |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. cheerful: | never true | | | | | | always true |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. moody: | never true | | | | | | always true |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. independent: | never true | | | | | | always true |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. shy: | never true | | | | | | always true |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. conscientious: | never true | | | | | | always true |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. athletic: | never true | | | | | | always true |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

11. affectionate:	never true						always true
	1	2	3	4	5	6	7
12. theatrical:	never true						always true
	1	2	3	4	5	6	7
13. assertive:	never true						always true
	1	2	3	4	5	6	7
14. flatterable:	never true						always true
	1	2	3	4	5	6	7
15. happy:	never true						always true
	1	2	3	4	5	6	7
16. stong: personality	never true						always true
	1	2	3	4	5	6	7
17. loyal:	never true						always true
	1	2	3	4	5	6	7
18. unpredictable:	never true						always true
	1	2	3	4	5	6	7
19. forceful:	never true						always true
	1	2	3	4	5	6	7
20. feminine:	never true						always true
	1	2	3	4	5	6	7
21. reliable:	never true						always true
	1	2	3	4	5	6	7

22. analytical: never true always true
 1 2 3 4 5 6 7
23. sympathetic: never true always true
 1 2 3 4 5 6 7
24. jealous: never true always true
 1 2 3 4 5 6 7
25. leadership: never true always true
 ability 1 2 3 4 5 6 7
26. sensitive to: never true always true
 other's needs 1 2 3 4 5 6 7
27. truthful: never true always true
 1 2 3 4 5 6 7
28. willing to: never true always true
 take risks 1 2 3 4 5 6 7
29. understanding: never true always true
 1 2 3 4 5 6 7
30. secretive: never true always true
 1 2 3 4 5 6 7
31. makes decisions: never true always true
 easily 1 2 3 4 5 6 7
32. compassionate: never true always true
 1 2 3 4 5 6 7

Appendix C

Bem's Sex Role Inventory Score Sheet

BSRI Score Sheet

MALE	FEMALE	NEUTRAL
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36
37	38	39
40	41	42
43	44	45
46	47	48
49	50	51
52	53	54
55	56	57
58	59	60

- Add up ratings in Male column and divide total by 20
- Add up ratings in Female column and divide total by 20
- Add up ratings in Neutral column and divide total by 20

Appendix D

Scenarios

Female Captain Scenario

Captain Lisa Winfield has been a 767 Captain for a major commercial airline for 5 years. She has logged a combined total of 6,000 hours on this particular type of aircraft in the positions of Captain and First Officer. As flight 1027 approached La Guardia International Airport, after a turbulent flight from Los Angeles, Captain Lisa Winfield made an announcement. She told passengers that the current conditions in New York were cold and rainy with winds out of the east at 20 knots, gusting at 35 knots. Additionally, she apologized for not being able to make up more than 30 minutes of the 2-hour delay of their flight. As the Boeing 767 was on final approach, the passengers could feel several abrupt power and heading adjustments. Subsequent to the unstable approach, there was a hard landing beyond the touchdown zone. Captain Lisa Winfield managed to bring the aircraft to an abrupt stop just shy of the end of the runway. The aircraft landing gear stress limits were exceeded and needed to undergo an inspection thus further delaying the next leg of the trip.

Male Captain Scenario

Captain Larry Winfield has been a 767 Captain for a major commercial airline for 5 years. He has logged a combined total of 6,000 hours on this particular type of aircraft in the positions of Captain and First Officer. As flight 1027 approached La Guardia International Airport, after a turbulent flight from Los Angeles, Captain Larry Winfield made an announcement. He told passengers that the current conditions in New York were cold and rainy with winds out of the east at 20 knots, gusting at 35 knots.

Additionally, he apologized for not being able to make up more than 30 minutes of the 2-hour delay of their flight. As the Boeing 767 was on final approach, the passengers could feel several abrupt power and heading adjustments. Subsequent to the unstable approach, there was a hard landing beyond the touchdown zone. Captain Larry Winfield managed to bring the aircraft to an abrupt stop just shy of the end of the runway. The aircraft landing gear stress limits were exceeded and needed to undergo an inspection thus further delaying the next leg of the trip.

Unspecified Captain Scenario

Captain Winfield has been a 767 Captain for a major commercial airline for 5 years and has logged a combined total of 6,000 hours on this particular type of aircraft in the positions of Captain and First Officer. As flight 1027 approached La Guardia International Airport, after a turbulent flight from Los Angeles, the Captain made an announcement telling passengers that the current conditions in New York were cold and rainy with winds out of the east at 20 knots, gusting at 35 knots. Additionally, an apology was made for not being able to make up more than 30 minutes of the 2-hour delay of their flight. As the Boeing 767 was on final approach, the passengers could feel several abrupt power and heading adjustments. Subsequent to the unstable approach, there was a hard landing beyond the touchdown zone. The Captain managed to bring the aircraft to an abrupt stop just shy of the end of the runway. The aircraft landing gear stress limits were exceeded and needed to undergo an inspection thus further delaying the next leg of the trip.

Appendix E

Perceived Competence Scale

Please answer the following questions by indicating only one answer on the scale for each question.

1. To what extent do you feel confident in the Captain's ability to safely operate an aircraft?

Low							High
1	2	3	4	5	6	7	

2. To what extent do you feel the Captain is capable of safely operating an aircraft?

Low							High
1	2	3	4	5	6	7	

3. To what extent do you feel that the Captain is able to operate an aircraft?

Low							High
1	2	3	4	5	6	7	

4. To what extent do you feel the Captain is able to meet the challenges that are faced when operating an aircraft?

Low							High
1	2	3	4	5	6	7	

5. To what extent was the role of Captain competently performed in the scenario?

Low							High
1	2	3	4	5	6	7	

Please provide the following information

1. Age _____

2. Sex _____

3. Are you a licensed pilot or pilot in training? _____

4. How often do you fly on a commercial airline?

a. Less than twice a year

b. Less than five but more than twice a year

c. Less than eight but more than five times a year

d. More than eight times a year

5. What is your level of apprehension about flying on a commercial airline?

No apprehension at all							Much apprehension
1	2	3	4	5	6	7	

Appendix F

Debrief Form

Study Conducted by Jan Laplante
Chair: Dr. Shawn Doherty
Embry Riddle Aeronautical University
Human Factors and Systems
Daytona Beach, FL. 32118

The study that you just participated in is concerned with the effects of gender on the perception of pilot competence. Three different scenarios that varied by the gender of the Captain in the scenario were utilized. Participants either received a scenario in which the Captain was identified (by name) as male, female, or unspecified. This was the only difference between the scenarios and all questionnaires were identical. The researcher is seeking evidence of the presence of a gender bias within the aviation community by observing gender differences in competency ratings. Your responses will enable the researcher to evaluate your perception of the competence of the Captain in the scenario.

Findings are expected to be evidence for the continued presence of a double standard in rating the competence of men and women within the aviation community. If it becomes recognized that members of a social category are commonly disadvantaged, in settings such as aviation that involve evaluation with a stricter ability standard, the situation must be rectified. Research in this area is needed in order to understand how male and female pilots are perceived and to provide a basis for continued research in this area that will provide insight to the challenges faced by women aviators.